

Claims

1.

3 A plug gauge for testing the mouth of a container, which includes:
4 a spring carried by a support,
5 a rod having one end coupled to said spring and an other end,
6 a plug coupled to said other end of said rod,
7 an electric motor, and
8 a control mechanism coupled to said motor and supporting said rod,
9 motion of said control mechanism by said motor lowering said rod and plug into
10 a container mouth under force of said spring and thereafter lifting said rod and plug out of the
11 container mouth.

2.

1 The plug gauge set forth in claim 1 wherein said control mechanism includes:
2 a rod arm slide on said support,
3 a crank arm coupling said motor, mounted on said support, to said rod arm slide,
4 and
5 a rod arm carried by said rod arm slide and slidably engaging said rod.

3.

1 The plug gauge set forth in claim 2 wherein said rod has a stop for engaging said
2 arm, said rod arm supporting said rod and said plug by engagement with said stop and being
3 movable away from said stop, by said rod arm slide, said crank arm and said motor, when said
4 plug engages a container mouth.

4.

1 The plug gauge set forth in claim 4 wherein said crank mechanism includes a link
2 arm coupling said crank arm to said rod arm slide, said link arm being movably connectable to
3 said crank arm for varying stroke of said rod and said plug.

5.

1 The plug gauge set forth in claim 1 further including a stripper operatively coupled
2 to said control mechanism for lowering against the container mouth, as said rod and plug are
3 lowered by said spring and said motor, and for holding the container mouth as said rod and plug
4 are lifted from the container mouth.

6.

1 The plug gauge set forth in claim 5 wherein said stripper includes a stripper slide
2 carried by said support and a lost-motion coupling between said stripper slide and said rod arm
3 slide.

7.

1 The plug gauge set forth in claim 6 wherein said stripper includes:
2 a stripper base carried by said support,
3 a stripper head coupled to said stripper slide, and
4 a stripper spring captured between said stripper base and said stripper head for
5 urging said stripper head into engagement with a container mouth when said stripper slide is
6 lowered into a container mouth by said lost motion coupling between said stripper slide and said
7 rod arm slide.

8.

1 The plug gauge set forth in claim 6 wherein said lost motion coupling includes
2 a stripper rod extending from said stripper slide through an opening in said rod arm, and a stop
3 on said stripper rod, such that said stripper slide is carried by said rod arm, through said stripper
4 rod, during initial downward motion of said crank mechanism and said rod arm slide and during
5 terminal upward motion of said crank mechanism and said rod arm slide, but is otherwise free
6 floating with respect to said rod arm slide.

9.

1 The plug gauge set forth in claim 1 further including at least one sensor coupled
2 to said spring and responsive to said one end of said rod for determining penetration of said plug
3 into the container mouth.

10.

1 The plug gauge set forth in claim 9 wherein said plug has a first neck test portion
2 adjacent to an end of said plug and a second cork test portion spaced from said end of said plug,
3 and wherein said at least one sensor is responsive to said one end of said rod to determine that
4 said neck test portion of said plug has penetrated the container mouth and that said cork test
5 portion of said plug has not penetrated the container mouth.

11.

1 The plug seal set forth in claim 10 wherein said motor comprises a rotary servo
2 motor, and wherein said gauge includes control electronics coupled to said motor for scanning
3 said at least one sensor when said rotary servo motor has fully lowered said plug toward the
4 container.

12.

1 The plug gauge set forth in claim 1 wherein said spring is an air spring.

13.

1 A plug gauge for testing the mouth of a container, which includes:
2 a support for mounting above a container inspection station,
3 an air spring carried by said support,
4 a rod having one end coupled to said air spring and an other end,
5 a plug coupled to said other end of said rod as a coaxial extension of said rod,
6 a rotary electric motor mounted on said support,
7 a rod arm slide carried on said support beneath said motor,
8 a crank arm coupling said motor to said rod arm slide,
9 a rod arm carried by said rod arm slide,
10 a stop on said rod for engaging said rod arm slide such that said rod arm supports
11 said rod and said plug by engagement with said stop and being movable away from said stop
12 when said plug engages a container mouth,
13 a stripper mounted on said support beneath said rod arm slide and operatively
14 coupled to said rod arm slide for lowering against a container mouth to hold the container in
15 position as said rod and plug are lifted from the container mouth, and
16 at least one sensor responsive to said rod for determining penetration of said plug
17 into the container mouth.

14.

1 The plug gauge set forth in claim 13 including a link arm coupling said crank arm
2 to said rod arm slide, said link arm being movably connectable to said crank arm for varying
3 stroke of said rod and said plug.

15.

1 The plug gauge set forth in claim 13 wherein said stripper includes a stripper slide
2 carried by said support and a lost-motion coupling between said stripper slide and said rod arm
3 slide.

16.

1 The plug gauge set forth in claim 15 wherein said stripper includes:
2 a stripper base carried by said support,
3 a stripper head coupled to said stripper slide, and
4 a stripper spring captured between said stripper base and said stripper head for
5 urging said stripper head into engagement with a container mouth when said stripper slide is
6 lowered into a container mouth by said lost motion coupling between said stripper slide and said
7 rod arm slide.

17.

1 The plug gauge set forth in claim 16 wherein said lost motion coupling includes
2 a stripper rod extending from said stripper slide through an opening in said rod arm, and a stop
3 on said stripper rod, such that said stripper slide is carried by said rod arm, through said stripper
4 rod, during initial downward motion of said crank mechanism and said rod arm slide and during
5 terminal upward motion of said crank mechanism and said rod arm slide, but is otherwise free
6 floating with respect to said rod arm slide.

18.

1 The plug gauge set forth in claim 13 wherein said plug has a first neck test portion
2 adjacent to an end of said plug and a second cork test portion spaced from said end of said plug,
3 and wherein said at least one sensor is responsive to said one end of said rod to determine that
4 said neck test portion of said plug has penetrated the container mouth and that said cork test
5 portion of said plug has not penetrated the container mouth.

19.

1 The plug gauge set forth in claim 18 wherein said at least one sensor includes first
2 and second sensors coupled to said air spring and responsive to position of said one end of said
3 rod.

20.

1 The plug gauge set forth in claim 19 wherein said motor comprises a rotary servo
2 motor, and wherein said gauge includes control electronics coupled to said motor for scanning
3 said at least one sensor when said rotary servo motor has fully lowered said plug toward the
4 container.

21.

1 A method of inspecting the inside diameter of a container mouth that includes the
2 steps of:

3 (a) providing a plug coupled by a rod to an air spring, and a motor coupled
4 to the rod by a rod arm,

5 (b) operating the motor to lower the rod arm such that the plug enters a
6 container mouth under force of the air spring,

7 (c) determining a diameter characteristic of the container mouth as a function
8 of penetration of the plug into the container mouth in said step (b), and then

9 (d) operating the motor to lift the rod arm and plug out of the container mouth.

22.

1 The method set forth in claim 21 including the steps of:

2 (e) during said step (b), lowering a stripper into engagement with the
3 container mouth to hold the container mouth in position during said step (d), and

4 (f) lifting the stripper out of engagement with the container mouth after the
5 plug has cleared the container mouth in said step (d).